Thermal Diffusivity of Iron and Fe-Ge Solution in Solid and Liquid States

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The paper presents results of the studies of Fe-Ge solution thermal diffusivity a(T) in the temperature range of 800 – 1700 K and germanium concentration range of 0.5 to 37.7 at.%

Measurements were performed with the aid of the thermal wave technique in the 3 – 10 Hz frequency range and with the aid of the pulse technique on testing rigs [1,2]. Measurement error was below 7%. Thermal curves a(T) are similar for all studied materials. The thermal diffusivity of studied substances in the considered temperature range increases monotonically by a nearly linear law. In the vicinity of the melting point, anomalies in the form of local maxima are observed on the thermal curves a(T), with the values of the maxima depending on the frequency of the thermal wave, independent of pulse width within the 3 ms range.

With further increase of the temperature, behavior of the thermal curve a(T) remains the same as in the solid phase. This testifies to the fact that melting does not cause essential changes in the electron and phonon spectra of alloys under investigation. An increase of thermal diffusivity can be explained within the framework of Mott's s-d model and can be connected with the reduction of d-electron density in the vicinity of the chemical potential.

[1] A.D. Ivliev and V.V. Morilov, Proc. 2nd Intl. Workshop on Thermal Physics – Tambov: Izd. TGTU, 146 (1995) (in Russian).
[2] S.M. Pervozchkov and L.D. Zagrebin, *Pribory I Tekhnika Eksperimenta, 155* (1998).